

NEWS



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**FOR RELEASE:** IMMEDIATE

I think you will find the accompanying speech  
by Dr. James C. Fletcher, Administrator, of interest  
as background information on current thinking at  
the National Aeronautics and Space Administration.

*Alfred P. Alibrando*

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Commencement Address  
By  
Dr. James C. Fletcher  
Administrator  
National Aeronautics and Space Administration

at the  
California Institute of Technology  
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POETS AND CARPENTERS

When the word first began to get around that I would be the Commencement speaker here this year, there were a number of interesting reactions -- some from students I had met earlier on this campus, others from individuals I did not even know. The suggestions and comments covered quite a wide range, but they seemed to have one thing in common -- namely, that there are certain subjects I should be wise not to talk about. Not that anyone thinks these subjects are taboo -- just trite.

Let me give you a brief sampling of some comments I received:

-- Don't give us any of the onward and upward, the future lies ahead kind of inspirational garbage.

-- Try being relevant for a change.

-- For heaven's sake don't talk about the benefits of the space program.

-- Don't talk down to us. Don't preach or pontificate.

-- Skip the customary platitudes and truisms and talk about something really practical and close to home -- like, maybe, the moral responsibility of the university to the inner city.

As you can see from these few samples -- and there were lots more -- the frequency count shows a predominance of "thou shalt nots," rather than "thou shalts." There wasn't any real unanimity of opinion, but, nevertheless, I was able to get a message. I'm sure I will not be able to avoid all the "shalt nots," but I'll try not to emphasize them unduly.

The world has changed a great deal since my own student days at Cal Tech both materially and philosophically. But from my vantage point on a university campus for the past seven years I find it difficult to believe that students themselves have become all that different, whatever seem to be outward appearances.

In many ways students know more and learn sooner than they did a generation ago. Cynicism is prevalent and sometimes very apparent. But idealism, which has been the province of youth since the times of antiquity, is still to be found. Students are still able to show emotion over ideas and ideals.

I am aware that some members of your own generation may use the word "emotion" in a pejorative sense. In fact, they can get pretty emotional about it. But that's their hang-up. I believe most of us still consider emotion a good honest word and a good honest human characteristic.

On this subject, let me recount to you a conversation I had last year with a few of our students. We had our problems during the Cambodian crisis and the situation remained quite tense while I and several others in administration tried to keep communication channels open with some of our most alienated students.

One of the leaders flatly told me I was a "rotten President" and ought to resign. I asked him to describe a good president. The reply was quick -- "a college

president ought not to be an administrator or an authoritarian figure" -- he ought to be a symbol, and a rallying point, for the students of his university. A good college president, he said, should participate in rap sessions with the students, understand their feelings, open up and make sincere, stirring but honest statements from the heart rather than the mind. He should be inspirational -- not coldly practical.

By the time he finished the description, I was beginning to get the picture. I said that it seemed to me what he was really looking for was a poet. He quickly agreed. Then I asked him what he thought I was. Again, he didn't take long to deliberate. "You," he said, "are definitely not a poet. You're a carpenter."

Well, maybe everyone has a secret desire to be a poet -- I really can't say. And maybe some people might think it's a put-down to be described either as a carpenter or as a poet, but I don't look at it that way. The world is full of both poets and carpenters and I believe each of us has within us some capabilities for both. The carpenters, the artisans, the engineers are

all problem-solvers, but I don't think this is necessarily bad. What is more, achievements of carpenters often fire the imaginations of the poets.

Poetry in its broadest sense is a creative act; the poet presents to us his vision of the undefinable. It's my belief that there is an underlying poetry in the adventure of science.

I suggest that poetry is the words that men reach for -- often inadequately -- to describe the emotions that stir them when they see and hear of such deeds as men first walking on the moon. The Bible and much of religion are poetry, too.

You who are here today are concerned with problem-solving, or you wouldn't have come to Cal Tech in the first place. But from my conversations with you, and from what I know about your generation, I know that you are concerned with much more than mere mechanics -- or carpentry, if you will. You cannot and will not ignore your moral responsibilities, your poetic selves.

All of us, whether poets or carpenters, must work within the limitations of our own abilities and our own

talents. La Rouchefoucauld wrote, some three centuries ago, a statement that is just as true today as it was then:

"God has put as different talents in man as trees in Nature: and each talent, like each tree, has its own special character and aspect . . . . The finest pear tree in the world cannot produce the most ordinary apple, and the most splendid talent cannot duplicate the effect of the homeliest skill."

So I think we must ask ourselves, where do our real talents lie? Should an apple tree try to be a pear tree? Should a carpenter try to act like a poet?

The question is a particularly tough one in this year of 1971, when so many members of the engineering profession are unemployed, or forced to accept work lying outside their specialties. It is a bitter pill to swallow, to spend your life learning particular skills and disciplines, and then to find that in many cases you cannot find suitable outlets for productive and creative endeavor.

The fact is, and we may as well face it, we are being confronted with a dilemma. Even though there are

many fields that demand our best engineering skills, there seem to be no channels through which we can bring them to bear.

NASA is probably as aware of the problem as anyone, because the agency has seen its aerospace work force drop from a peak of more than 400,000 a few years ago to something less than 150,000 today, with the curve only now beginning to flatten out. It is easy for those who are not affected directly to say that these things are always cyclical -- even though from the historical point of view they may be right. It really isn't all that comforting, just to know that something has happened before and probably will happen again. As I recall, just about two decades ago, Life magazine devoted most of an entire issue to a very severe problem of that time -- unemployed engineers.

My considered opinion is, recognizing that the times are difficult, that this country needs its engineers today more than ever before. One of the troubles is that not everybody knows it yet. Particularly in recent months, we hear strident voices raised on every side,



saying that science and technology lie at the root of all our problems. To hear some people tell it, technology is an invention of the devil and the best thing we could do would be to forget the whole thing. They apparently believe -- and I think they are quite sincere about it -- that all we need to do is to go back to the good old days of the sailing ship and the horse and buggy and all our problems will automatically fade away. This simply isn't possible -- a society can never retrace its history. Even if society as we know it were to be destroyed and a fresh start made, there is no reason to believe that we would arrive again at the good old days or that they would seem so good if we did.

While it is true that technology lies at the root of some of our problems -- certainly not all of them by any means -- it is equally true that technology offers our best and sometimes our only hope of dealing with many of these problems.

In many ways I think we tend to take too narrow a view. We talk about poverty, for example, as if it were a single, distinct problem that we can single out and

attack head on. But we really know that it is an intrinsic part of a much larger economic fabric.

One of the world's truly original thinkers, Buckminster Fuller, (who, I understand, recently visited with you here at Cal Tech) believes that the answer lies in learning to do more with less. Says Fuller:

"In this century we've gone from less than one percent of humanity to forty percent of humanity enjoying a higher standard of living than any king we knew of before the 20th Century. This is despite the fact that during that time the resources per capita have been continually decreasing. The way we got to taking care of forty percent of the people was by doing more with less. And this is not in the economics books."

Something else that may not always be in the economics books, although it should be, is the interlocking relationship between economics and technology.

Sound economics, sound technology and sound culture, all go hand in hand. I find it almost impossible to conceive of a modern country that has a well-advanced and successful high technology that does not also have

a strong economic base, nor one with a strong economic base without a truly advanced technology. In ancient times, that base was built largely on trade. The ancient Phoenicians, the master traders of their era, carried knowledge as well as goods throughout the then-known world.

The Greeks, who learned from the Phoenicians, built a golden age of art and culture and science and philosophy upon the same kind of solid economic base. It might also be argued that the trade itself grew out of the technology of ships; a more or less chicken-and-egg relationship. In any event, economics, technology, and the arts all flourished, and they flourished together.

During the Renaissance there was a repetition of the now familiar pattern. It was certainly not an accident that the age of the great explorers, Columbus, Magellan and the rest, was also an age of intellect -- science and poetry and art and music and architecture.

The economic and trade base is equally obvious today. I would submit that West Germany and Japan, along with our own country, are excellent cases in point -- our

economic base is strong because our technology is advanced. Because of this the leading scientists, artists, musicians of the world come from those countries.

I would like to stress my strong belief that the future prosperity of this country depends on our continued development of high technology.

In this century, world leadership in nearly every important area of human endeavor has shifted from Europe to America. But simply because we now are in the lead does not necessarily mean that we will continue to hold that position without further effort on our part. Japan, China, the U.S.S.R., the Common Market countries of Western Europe -- all are challenging our leadership, and they are doing it by trying to beat us at our own game: technological pioneering.

Now, the key to success in a great modern industrial state is productivity. And in the modern industrial state it has to be stated as rising productivity. We can't expect "cost of living" increases, retirement benefits and medical benefits all to occur simultaneously unless

productivity increases. Nor can we maintain our current living standards and at the same time reduce poverty, alleviate urban blight or improve our physical environment without increasing productivity. And productivity in our modern society is almost completely dependent on an advancing technology.

To be sure, advancing technology without appropriate social direction is a source of many current crises -- nuclear war, pollution, rural depletion, population increases, etc. Technology perhaps can be blamed, but rather it is the lack of appropriate social institutions to direct and control advancing technology that is the source of much of our concern. Bad government, the military-industrial complex, inflexible institutions (including our educational systems) are also to be blamed.

It is not my place to tell you that things are going to be simple or easy. My generation cannot offer any homilies on how to choose and achieve your particular life styles. Mostly what we can offer is wisdom, but since wisdom is heavily experienced-based, it's likely to be obsolescent in today's world of accelerating change.

Anyway, you would probably resent it if I were to try. But I do think we can at least try to pass on to you some of the things we may have learned, and the acceptance or the rejection is up to you.

So I will simply say that it would seem advisable to keep as many avenues open as possible -- I think "stay loose" is the phrase -- and to realize that the world desperately needs problem-solvers, and since your talents more than likely lean in this direction, they can be applied in many different ways.

One of the paths we can take -- the obvious one -- is to help develop some new area of high technology that will serve to strengthen our Nation's economic base, and thus indirectly, our whole culture. We don't necessarily have to perform this task with productivity foremost in our minds, as I have explained -- even though that's really the way it works.

A second path -- and the demand for this path will be growing rapidly, I believe -- is to attack directly the social, economic, and other serious problems of our time that have a definite technological component.

Problems of ecology -- air pollution, water pollution, and so on, have technological solutions. Urban and interurban transportation have technological solutions. As soon as we determine the appropriate political system which will spend the time and money, we already know a good deal about how to solve problems like these, and what remaining technology needs to be developed will undoubtedly appear.

Other problems such as rural and ghetto health, housing, hunger, and poverty, have only a partly technological solution; still others, with strong human and sociological components, are even harder to deal with, and it may be a long time before problem-solvers learn to deal with "people" problems. Until then, we may have to rely on the poets.

Here I would remind you once again that -- while it wasn't easy to land men on the Moon -- it was nevertheless a straightforward, engineering kind of problem. And as someone has said, there weren't any people between here and there.

Let's face it -- problems that involve human beings as a major part of the equation are much harder to solve. That doesn't mean that the carpenters of the world shouldn't tackle those problems, too. It simply means that we must always be aware that there won't be any instant solutions. Some solutions take longer than others. Social mores are not changed overnight.

The third path then that lies open to our profession -- and I think relatively few persons yet realize what a broad and important path it can be in the years ahead -- to pursue long-range study and research on the application of problem-solving techniques to some of the more purely human problems. Some extremely interesting experiments in this direction are already going on, enough to show us that the promise is enormous.

For example: I am sure you know that some of the pioneering studies were done in California a few years ago by some of the aerospace companies, applying systems engineering techniques to study problems of transportation, crime, and communications, among other things.



An extremely interesting experiment in what is called "incentive welfare" is now going on in New Jersey. Problems of this kind are being studied increasingly at universities and urban institutes.

Systems engineering techniques are now being applied even in some of our law schools to improve our criminal justice system, with the idea of not only trying to reduce the crime rate but, if possible, to speed up the system, i.e., to determine guilt or innocence much more rapidly but without diminishing the reliability of the verdict or denying the rights of the individual.

From all this, I think a pattern is emerging, and I believe that our country's leadership in technology will respond to the challenges of the times and continue to move ahead.

One final point: If we look at the industries which have contributed to our country's greatest growth during the last decade or two, we quickly uncover such fields as computers, electronics, automatic controls, photography, new material, new chemical or physical processes for consumer or industrial use. It is no

coincidence at all that these are all high technology industries and that most of this technology was stimulated by government need in some particular field or another. It is well known, for example, that after each major war, from the Middle Ages on, new technology sprinted ahead. AEC and NASA are peaceful ways of accomplishing the same thing. In William James' phrase, what we need is a "moral equivalent of war." As a substitute, AEC, NASA, NSF, NIH may serve, insofar as the technological aspects are concerned.

It is a source of wonder and amazement to me that there are still voices crying out to cut our science and technology programs even more deeply than they have already been cut -- as if the money being spent for productive, economically valuable technology could be better spent on enterprises that spend existing capital rather than creating new wealth.

For example, Western Europe is seriously considering participating in our space shuttle development, because they can readily understand the value of shuttle technology to their own development. Other countries,

even the economically weak emerging nations, appreciate the value of high technology, but some of our own citizens seem to be quite blind to it.

But that is the way of history. We are still really only at the beginning. I think the developments that take place in the next few years will be enough to convince even our severest critics, that all such programs -- and the high technology that goes with them -- are relevant, and indeed indispensable, to the better world all of us hope for, provided we take care that this new technology is directed toward useful projects and that the side effects are manageable in our complex human socio-economic system.

Perhaps I could be permitted to quote George Wald, a distinguished biologist and Nobel Prize winner: "Our generation cannot and should not assure the young of a real future." In light of the population explosion, pollution and nuclear war, such a statement might be accurate but is certainly not particularly constructive. It does call attention to the problems we face, and although a bit poetic does offer us a real challenge.

The challenge we face, and I think we face it together, not as separate generations, is to delineate the problems as clearly as possible and then go to work on them in any way we know how, in whichever manner best suits our talents. We do have time, but not much, so let's get with it.